

NOTES ON THE CYCLANTHACEAE OF SOUTHERN CENTRAL AMERICA INCLUDING THREE NEW SPECIES

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Although often abundant in tropical primary forest, the Cyclanthaceae have been poorly known for two major reasons: they are most diverse in some of the least explored habitats, namely the wettest areas, and the plants are difficult to collect and thus often ignored by collectors. The following notes and new species, resulting from over two years of field work at La Selva field station in northeastern Costa Rica and four field trips specifically to study Cyclanthaceae in various parts of Costa Rica and Panama, are presented here to provide names for new species in the Flora of La Selva (Hammel, 1986).

NOTES

When Harling (1958) monographed this family he treated a total of 180 species in eleven genera. At that time 37 species in eight genera were known from Central America. Recent collecting, especially in Costa Rica and Panama indicates that there are probably twice that many species in the region. All of these will be treated in the Cyclanthaceae for Flora Mesoamericana, which I am preparing. No additional genera have been found since Harling's monograph, but 29 new species have been described (Schultes, 1959; Harling, 1963, 1972, 1973; Wilder, 1978; Grayum & Hammel, 1982; Galeano & Bernal, 1984), four of them from Central America.

It is not yet clear whether the increase in numbers of species known from Central America will be due more to newly discovered endemic species or to range extensions from South America. In many cases this question can only be answered by revisionary work with a strong field orientation; nearly half of the species in Harling's monograph were known only from the type collection. Nevertheless, range extensions for several distinctive species can now be indicated.

Range Extensions

Although Cyclanthus is usually treated as a monotypic genus, the first new species in the family to be described after 1958 was C. indivisus Schultes (1959). This species was described from the Amazonas commissary

of Colombia and is distinguished by its smaller habit and undivided mature leaves. Plants of this species are now known from certain areas of primary forest in Colon and Panama provinces and in the Comarca of San Blas just north and east of Panama City. Ludovia lancifolia Brogn., which Harling recorded only tentatively from Central America, is now definitely known from these same areas in Panama. Also, Ludovia integrifolia (Woods.) Harl., known previously in Central America only from Darien Province of Panama, has now been collected from numerous sites along the Caribbean lowlands as far north as southeastern Nicaragua. Likewise, the monotypic genus Thoracocarpus had been known in Central America only from Darien Province of Panama but is now known to extend into Bocas Del Toro Province and southern Costa Rica. Numerous species of Asplundia, Dicranopygium and Sphaeradenia, formerly known only from South America, are also now known from Central America. These will be dealt with in subsequent papers.

Key to the genera

For the most part Harling's genera are easily distinguished, and probably monophyletic, however, his monograph is not widely available. According to the floristic treatments that are still primary sources of names for plants of the region (i.e. Flora of Guatemala and Flora of Panama--both published prior to Harling's treatment) most species in Central America would be treated as members of the genus Carludovica. The following key, emphasizing vegetative characters of the eight genera from Central America, should help to correct this problem.

1. Leaf blades with 2 major lateral costae running nearly the entire length of the blade, usually deeply bifid nearly to the base; spadix a cylinder of rings formed by alternating staminate and pistillate units; plants terrestrial, usually acaulescent CYCLANTHUS
1. Leaf blades with the 2 lateral costae (if present) always disappearing well below the tip of the blade, entire to deeply divided; spadix a cylinder or sphere of tightly packed but distinct staminate and pistillate flowers; plants epiphytic, epipetric, or terrestrial, often caulescent

2. Petioles mostly 1.5 to 3 m long, terete; leaf blades palmately divided into 4 segments, the segments deeply toothed; plants terrestrial; surface of the mature spadix irregularly splitting back to reveal the bright orange seed pulp and rachis; seeds angular CARLUDOVICA
2. Petioles less than 1 m long flattened above; leaf blades usually entire or bifid, not toothed (very rarely palmately divided and deeply toothed but the plants then epiphytic); surface of mature spadix not splitting back; seeds flat or terete
3. Leaves with 2 conspicuous lateral costae about as thick as the midrib ASPLUNDIA
3. Leaves without conspicuous lateral costae
4. Spathes (or their scars) clustered immediately below the spadix
5. Plants long-stemmed and branched, usually climbing; stems and dry leaves scabrous; fruits separate to base; seeds flat, orange EVODIANTHUS
5. Plants mostly nearly stemless, unbranched, usually growing on rocks along streams, rarely with a short stem and climbing a short distance; stems and leaves not scabrous; fruits united most of their length; seeds terete, purple DICRANOPYGIUM
4. Spathes dispersed along the peduncle
6. Leaves distichous
7. Leaf blades never bifid; fruiting spadix nearly smooth, the pistillate flowers embedded in the rachis and very distant; plants lianas or nearly stemless epiphytes LUDOVIA

7. Leaf blades of mature individuals bifid; fruiting spadix not smooth; plants terrestrial or epiphytic, usually nearly stemless
..... SPHAERADENIA

6. Leaves spirally arranged

8. Petioles broadly channeled their entire length; many nearly mature-sized leaves undivided; mature fruiting spadix often 6-7 cm in diam., the fruit surface lustrous, hard, and brittle; spathes 8-11; plants lianallike canopy climbers THORACOCARPUS

8. Petioles broadly channeled only at the base; mature-sized leaves always divided; mature fruiting spadix usually less than 3 cm in diameter, the fruit surface not lustrous, hard, and brittle ; spathes 2-8; plants low trunk climbers or terrestrial ASPLUNDIA

NEW SPECIES

Carludovica sulcata Hammel sp. nov. **Figure 1.** TYPE: Costa Rica, Prov. Heredia, Finca La Selva, 7 August 1983, Hammel 13330 (holotype: DUKE; isotypes: CR, F, MO).

C. drudei Masters affinis sed dentibus marginalibus laminas semper regularibus, ca. 10 cm longis; stigmatibus late sulcatis et basi staminodiorum persisteni.

Terrestrial, acaulescent plants to 2.5 m tall. Segments of the leaf blades about 75 cm long, 25 cm wide, dividing the blade to within 5 cm of the base, dark green; teeth of the blade to 10 cm long, 2-3 cm wide. Spathes 3; spadix to 12 cm long. Staminate flowers with 20-25 tepals, stamens 50-90, anthers 1.2 mm long. Stigmas more or less linear but deeply sulcate, spreading wide in fruit, mounted on the ovate or rectangular-inflated style, not uncinat.

SPECIMENS EXAMINED. **Costa Rica**, Prov. Heredia, Finca La Selva, Hammel 10960, 13108, 13246; McDougal 1029 (DUKE); **Nicaragua**, Prov. Rio San Juan, Cano Santa Crucita, Araquistain 3267 (MO).

PHENOLOGY. Flowering mid rainy season July and August, fruiting late August to early October.

DISTRIBUTION AND HABITAT. Carludovica sulcata is known only from the Caribbean lowlands of northeastern Costa Rica and adjacent Nicaragua. It is common in old secondary woods and occasional along streams in the primary forest at La Selva, the type locality. Carludovica rotundifolia Hook. f. also occurs at the type locality but is much less common and found only in a few areas on steep riverbanks.

RELATIONSHIPS. Carludovica is the only genus of Cyclanthaceae that is more diverse in Central America than in South America. As pointed out by Harling (1958) the ubiquity of plants in this genus (especially C. palmata Ruiz & Pavon, which is cultivated as a yard ornamental in many parts of the tropics) as well as their bulkiness has led to their being considered uninteresting taxonomically and ignored by collectors. One goal of my current work on Carludovica is to expose its diversity; at least 1 or 2 more species will need to be described from southern Central America. Carludovica sulcata brings to four the total number of species recognized in the genus. It is closely related to C. drudei Masters by virtue of its relatively long pistillate tepals and sessile stigmas. It differs primarily in its deeply sulcate stigmas--from which the specific epithet derives--and persistent staminodial bases. Both C. drudei and C. palmata appear to be polymorphic for the length of the marginal teeth of the leaves, some populations being deeply, irregularly toothed and others with relatively shallow, regular teeth. Both C. rotundifolia and C. sulcata, however, always have relatively regular and shallow marginal teeth.

Dicranopygium umbrophila Hammel sp. nov. Figures 2 & 3. TYPE: Costa Rica, Prov. Heredia, Finca La Selva, 20 May 1982, Hammel 12386 (holotype: DUKE; isotype: CR).

Dicranopygium izabalensis Harl. affinis sed plantae terrestres vel raro epiphyticae, in silva nunquam ad saxos in rivulis vigen; petioli purpurei ad basim; spathae internus purpureae; pedunculi purpurei; stamina (20-35), ca. triplo numerosi quam D. izabalensei.

Terrestrial or sometimes climbing, caulescent plants usually about 50 cm tall. Leaf blades 30-45 (47) cm long, uncostate, bifid for 1/2 to 2/3 their length, the divisions (4) 5-7.5 (10) cm wide; petiole 30-50 cm long, purple brown, scurfy below. Peduncle 3-7 cm long at anthesis, (7) 17-19 (30) cm long in fruit, purple and covered with brownish scurf below. Spathes 2, 3.5-4.5 cm long, purplish inside. Receptacle of the staminate flowers flat; perianth lobes (4) 6-7 (9); stamens (20) 24-32 (35), anthers 0.9-1.1 (1.3) mm long, 0.5-0.6 mm wide, filaments no more than 0.1 mm long; basal bulbs large, globose. Tepals of the pistillate flowers truncate, connate at least in later stages, lower than the stigmas, 5-8 mm wide in fruit; stigmas narrowly oblong overall and sometimes slightly projecting through the tepals, ca. 3 mm long in fruit, the actual stigmatic crest linear. Fruiting spadix 3-4.5 cm long, 1- 1.5 cm thick.

SPECIMENS EXAMINED. Costa Rica, Prov. Heredia, Finca La Selva, Beach 1437; Chacon 874; Grayum 2533, 2972; Folsom 9619, 9891; McDowell 112, 1059; Hammel 8645, 9434, 12386; Wilbur 30040, 30046; Wilbur & Jacobs 34926 (all at DUKE).

PHENOLOGY. Flowering and fruiting throughout the year.

DISTRIBUTION AND HABITAT. Dicranopygium umbrophila is known for certain only from La Selva in northeastern Costa Rica. Many collections from Panama also appear to belong to this new species but will be cited later in connection with a revision of the genus for Central America. The species is sympatric at La Selva with D. wedelii Harl., which is often abundant and restricted to rocks in small streams or open banks along rivers. Unlike the great majority of species of Dicranopygium, which are stream-loving (fide Harling, 1958), D. umbrophila is quite common in the forest understory. At La Selva it is met with most frequently in swamp forest where it is often seen to climb on fallen logs or a short distance up tree trunks. Its purplish peduncles, brownish scurf, and forest habitat help distinguish D. umbrophila from other Central American species.

RELATIONSHIPS. Dicranopygium umbrophila belongs to subgenus and section Dicranopygium, the largest group in the genus. It appears to be most similar to D. izabalense. Its relationships will be discussed in more detail in a forthcoming revision of the Central American members of the genus.

Sphaeradenia pendula Hammel sp. nov. Figures 3 & 4.
TYPE: Hammel 9528 (holotype: DUKE; isotypes; CR, MO).

Sphaeradenia ensiformis (Hook.) Harl. affinis sed plantae pendulae; laminae longiores (65-95 cm) et angustissimae (1.5-2.5 cm); petioli longiores (40-70 cm); flores masculini breviores (2.5 mm) et angustiores (1.5 mm), tepalis paucioribus (4-6); fructus virides a flavidus, indehiscentes.

More or less acaulescent pendent epiphytes. Leaf blades very thick, coriaceous, divided nearly to the base, the divisions 65-95 cm long, 1.5-2.5 cm wide; petiole 40-70 cm long. Spathes 3-4, the lowermost one to 14 cm long, 1 cm wide, acuminate. Flowering spadix 3 cm long, 1 cm thick, in fruit to 8 cm long, 2.5 cm thick, green. Staminate flowers asymmetrical, 2.5 mm long, 1.6 mm wide, stamens 20-25; anthers 0.6-1.0 mm long, 0.4 mm wide, provided with a small secretion globule; basal bulbs same diameter as the anthers. Pistillate flowers separate to the base; tepals connate at base in fruit; style about the same height as the tepals; ovary distinctly protruding from the spadix at maturity, the separate fruits indehiscent. Seeds elliptic, funiculus end blunt and mucilaginous, chalazal end with an acuminate appendage.

SPECIMENS EXAMINED. Costa Rica. Heredia: Finca La Selva, Folsom 9552; Grayum 1957; Hammel 9528, 10737, 11514; McDowell 1055; D. Smith 399, 590 (all DUKE). Panama. Bocas Del Toro: Hammel 13708.

PHENOLOGY. Flowering from August probably through December, fruits maturing January through April.

DISTRIBUTION AND HABITAT. This species is known from primary forest in the Caribbean lowlands of northeastern Costa Rica to wet hills and lowlands of central Panama. It is one of the most common and distinctive of all the canopy epiphytes in the areas where it grows. Very few other species of Sphaeradenia occur at low elevations.

RELATIONSHIPS. Although S. pendula resembles S. ensiformis even in many details of the flowers, it is nevertheless a quite different species. The leaves of S. pendula are much longer than and never as wide as those of S. ensiformis. Sphaeradenia pendula occurs at lower elevations than S. ensiformis but the two can be found sympatric at elevations of about 300-500 m. The male flowers are about half the size of those of S. ensiformis and they have fewer perianth lobes.

The fruits of S. ensiformis are described as changing from green to red to yellowish white at maturity whereas those of S. pendula apparently remain green or become somewhat yellowish. The fruits of S. ensiformis are said to be very fragrant at maturity. This is true also at least for some individuals of S. pendula; the fruits of the plant here figured had a very strong fragrance of Juicy Fruit gum. Because of their brightly colored and juicy (non fragrant) mature fruits with dehiscent caps, most species of Sphaeradenia would appear to be bird dispersed. However, S. pendula and several closely related species with green to yellow-green, very hard leathery or rubbery, indehiscent and at least sometimes fragrant fruits seem more likely to be dispersed by bats or other mammals. Nevertheless, old fruiting spadices of S. pendula and related species are often found intact, fallen or on plants, but dry and almost woody, the fruits containing still turgid seeds. These spadices are sometimes also found covered with their own seedlings, the seeds having germinated in situ.

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FIGURE CAPTIONS

Figure 1. Carludovica sulcata, mature spadix. A, stigma. B, base of staminodium. C, pistillate tepal. (Hammel 13246; scale bar = 1 cm).

Figures 2 and 3. Dicranopygium umbrophila. 2. Habit (scale bar = 10 cm). 3. Mature spadix (scale bar = 1 cm). (Hammel 12386).

Figures 4 and 5. Sphaeradenia pendula. 4. Habit (scale bar = 1 m). 5. Mature spadix (scale bar = 2 cm). (Hammel 13708).



